

Reducing Risk from Soil Metals: Summary of a Field Experiment

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Lead (Pb) poisoning is the most common and most serious environmental disease affecting young children, according to the Centers for Disease Control and Prevention (CDC). During the past 25 years, accumulating information supporting the adverse affects of elevated blood Pb on cognitive development has resulted in CDC lowering the defined elevated blood Pb level for children aged <6 years from 25 to 10 $\mu\text{g Pb dL}^{-1}$. Likewise, excessive zinc (Zn) will interfere with the metabolism of other minerals in the body, resulting in deficiencies, particularly of iron and copper. Cadmium (Cd) can cause the risk of renal lesions, leading to tubular microproteinuria. Exposure route for these metals include oral consumption of contaminated soil, consumption of plants grown on contaminated soil, and drinking of contaminated water. Traditional methods for reducing risk from elevated levels of soil Pb, Cd, and Zn involve removal, covering, or dilution by mixing with uncontaminated soil. Believing that *in situ* remediation techniques are viable alternatives, the EPA's National Risk Management Research Laboratory and DuPont Corporation established the In-Place Inactivation and Natural Ecological Restoration Technologies (IINERT) Soil-Metals Action Team as part of the Remediation Technologies Development Forum for collaborative effort to evaluate *in situ* remediation technologies.

A field experiment at a smelter metal-contaminated urban site in Joplin, MO, was established as part of this collaborative effort. IINERT technologies chemically and physically inactivate hazardous metals found in contaminated soils by reducing and essentially eliminating their solubility and bioavailability without the need for excavating the soil. *In situ* incorporation of chemicals, such as phosphates, mineral fertilizers, iron oxyhydroxides, other minerals, biosolids, or limestone changes the molecular species of the metals. Changing a metal's molecular species may reduce its water solubility, bioavailability, phytoavailability, and potential toxicity to humans and the environment. However, the total concentration of the metals may not necessarily change.

Of the treatment options available for remediating metal-contaminated soils, in-place inactivation appears to be the most cost-effective. Additionally, it reduces the hazard posed by the contaminated soil in place. Since burying contaminated soil in a landfill or covering it over is not necessary, the potential for degradation and contamination of other areas is minimized. Reductions in Pb, Cd, and Zn bioavailability (*in vivo* and *in vitro*), phytoavailability, and changes in geochemical speciation observed as a result of *in situ* treatment demonstrate that reduction in soil metal risk can be accomplished without soil removal in our field study.